Abstract

Lead-free solder balls having a smooth surface and no shrinkage cavities or wrinkles are made of a lead-free solder which comprises, by atomic percent, 3% - 6% of Ag, 1% - 4% of Cu, 0.01% - 2% of at least one element of the iron group and preferably Co, optionally 0.04% - 4% of P, and a balance of Sn.